

Flood Lighting Projectors



"Golden Glow" and "Crystal Mirror"

Manufactured by

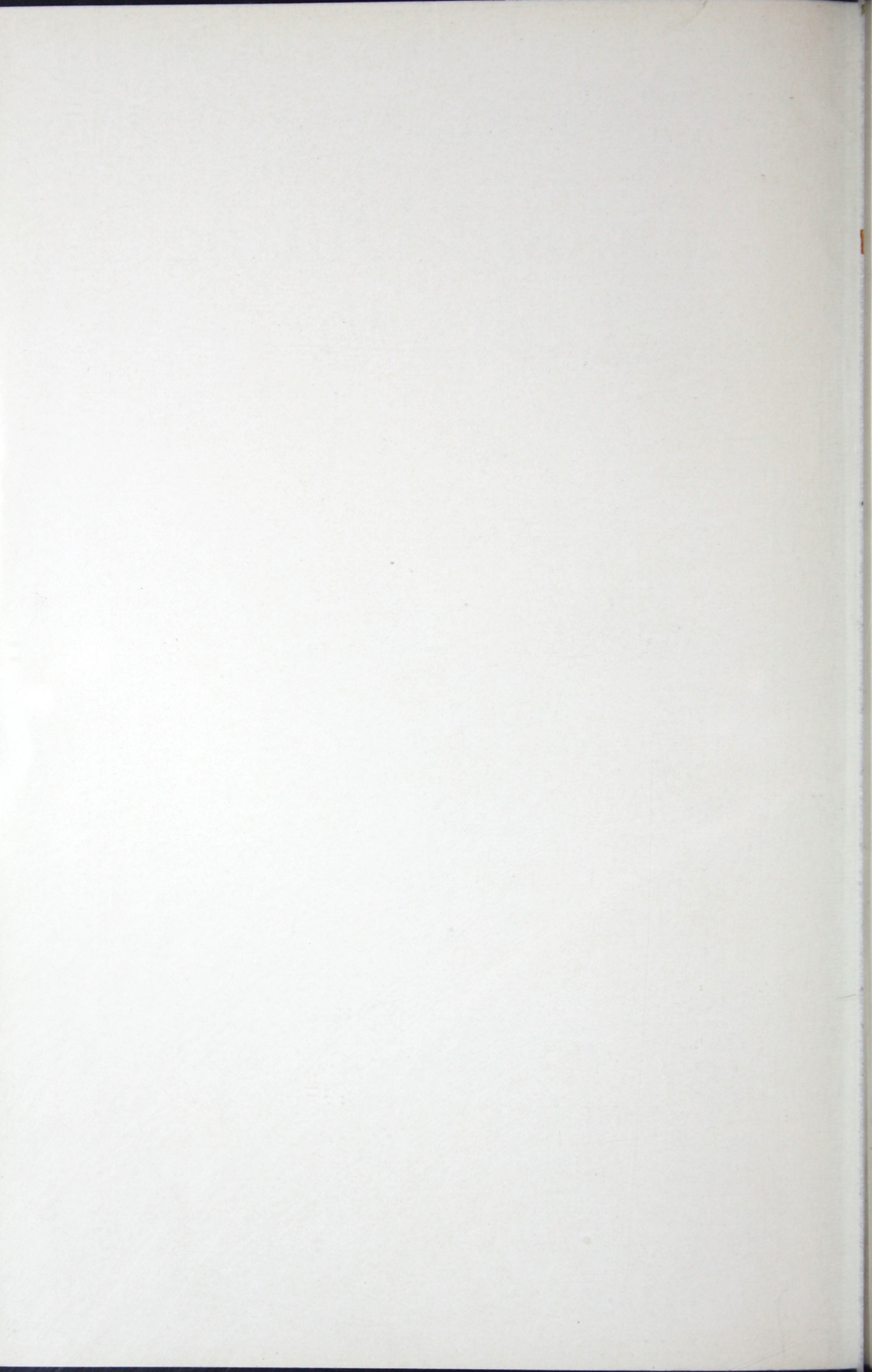
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Flood Lighting

LIGHT is one of the supreme blessings accorded the universe; man instinctively shrinks from darkness; he loves light, he thrives in light, he lives in light; life in a world of darkness is unthinkable. And because of this, because of our inherent desire towards dispelling darkness, may be attributed the wonderful advances which history accords in the creation and utilization of this most wonderful form of energy. One of the most interesting developments of lighting and one which promises wide and general adoption to many and varied uses is "Flood Lighting."

"Flood Lighting," or what might aptly be termed "illumination by projection," owes its inception and development to two phases of the lighting problem—the æsthete and the business.

What is more impressive than a beautiful statue or building flooded with light and standing out in all its details from its background of night! What can compare to the splendor of a fountain playing under a flood of projected light and reflecting from its myriad drops a veritable chaos of intermingled and beautifully colored beams! Surely from the æsthetic viewpoint flood lighting offers possibilities for spectacular and inspiring effects not approached by any other form of illumination.

To take now the business side of flood lighting.

Roughly, and for purposes of differentiation only, flood lighting considered from the business standpoint may be said to be employed for four purposes:

(1) *Æsthetic*; which again may be classed as the use of flood lighting to depict and enhance the beauty of objects so illuminated.

(2) *Advertising*; this borders closely on the above, though as generally considered the results to be secured are different.

(3) *Pleasure*; permitting the enjoyment of various recreations at night quite as fully as during the daytime.

(4) *Utilitarian*; broadly speaking, the adoption of flood lighting to industrial needs.

To show and to explain briefly the uses to which flood lighting in each of these four classes may be adapted, let us in a few words consider each.

Æsthetic flood lighting appeals at once to the sense of the beautiful; monuments, for example, or interesting places, public buildings, fountains, parks, etc., under their flood of projected light are brought at night into even greater prominence than in the daytime; such lighting is both dignified and effective and lends itself well to a multitude of applications.

Æsthetic flood lighting aside from its impressiveness from the spectacular point of view has a definite and valuable business side as well. A city possessing flood lighted objects secures direct and valuable advertising possible by few other means; flood lighting spells progressiveness—progressiveness not only for the city and its inhabitants in general, but for the central station and all concerned.

The advertising value of light has long been recognized; merchants were quick to recognize the advertising possibilities of well-lighted store interiors; this led to beautiful and well-planned window lighting; to exterior lighting of the stores' sidewalks and signs. It was but a step further to the illuminated sign, and with the advent of flood lighting there came the possibilities of projecting light over the exterior of the whole building, as well as onto signs, water tanks, billboards and for various other advertising purposes, where before flood lighting became generally available such lighting was either impracticable because too expensive, or practically impossible owing to the extreme difficulty that would be experienced in carrying wiring to the desired location.

For advertising purposes the field of flood lighting is practically unlimited, and owing to its beauty, its effectiveness, its economy and its ability to meet and surmount the most difficult conditions its field may be expected to enormously increase.

To consider the effect which flood lighting has had in enabling thousands of persons to enjoy to the fullest extent pleasures which darkness would otherwise have rendered impossible, one has only to consider the wide adaptation to which flood lights have been placed in illuminating bathing beaches, skating ponds, tennis courts, athletic fields, rifle ranges, gun clubs and much more. Surely in bringing to realization this aspect of life with its beneficial effects on those who otherwise would be deprived to a large extent of such healthful recreation, flood lighting has rendered a benefit to mankind difficult to overestimate.

Then there comes what might be termed the purely utilitarian side of flood lighting, or the use of flood lighting in industrial enterprise. A few such uses may be said to be those connected with construction work which must be pursued by night; the illumination of docks and wharves, arsenals, ammunition plants, fire fighting, linemen's repair wagons, and much more.

Flood lighting for these purposes possesses the advantages of low cost, great portability and adaptability; flood lighting installations are simple to install and maintain; so simple in fact that with due observance to the fundamental rules as outlined in this book, most anyone will be

enabled to lay out and install flood lighting installations that will give exactly the results desired. These advantages, in conjunction with the important fact among others, that by its means we are enabled to illuminate objects located at considerable distances from the projector, make it peculiarly attractive for this purpose. In so offering an effective substitute for daylight, flood lighting has added immeasurably to our efficiency as an industrial people.

Flood Lighting Projectors

THE flood lighting projector is the heart of every flood lighting installation, whether it be a single projector illuminating a simple sign or used in a small industrial operation, or whether it be a battery of several hundred illuminating an entire building or a large industrial enterprise. On the projector depends not only the effectiveness or efficiency of the installation, but the economy as well; for the projector is simply the means of utilizing the light flux from the source, which is invariably a high efficiency concentrated filament type incandescent lamp, and re-directing and projecting it to its point of utilization.

Electric light, light flux or lumens, whichever term one may use, represents a definite amount of energy; to utilize the maximum percentage of this light flux and to direct same to its point of utilization has been the underlying aim in the design of "Crystal Mirror" and "Golden Glow" Flood Lighting Projectors; they represent, and we weigh our words carefully when we make this statement, unquestionably the most highly developed and most efficient projectors ever developed for this service. The proof of this statement will be apparent from a consideration of the various factors entering into their design and construction.

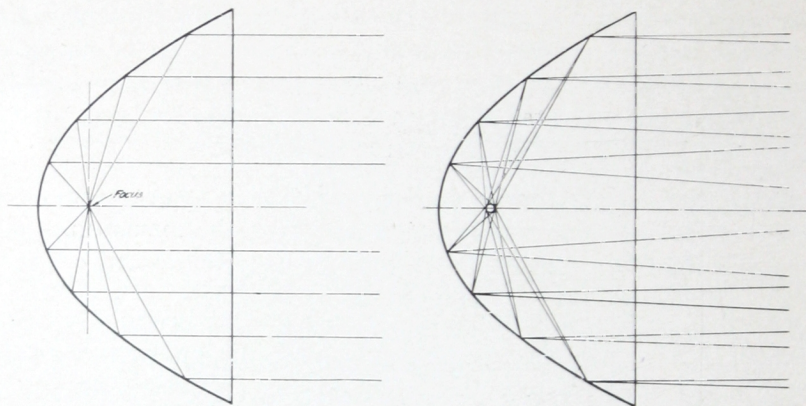
In both the "Crystal Mirror" and "Golden Glow" type of projector the light source used is a 400 watt, 105-130 volt concentrated filament type Mazda C flood lighting lamp. The 200 watt Mazda C flood lighting lamp may also be employed for short-range work, or where the volume of light secured from the 400 watt lamp is deemed unnecessary; though for most purposes the latter lamp will be found preferable.

In both projectors parabolic glass reflectors, 14 inches in diameter, are employed, the difference between the two being that one is made of our famous "Golden Glow" glass used so extensively for electric and steam railroad headlights and for marine searchlights, while the other is made of clear "Crystal Mirror" glass. The relative advantages of the one over the other will be explained later.

These parabolic glass reflectors or mirrors are first moulded in the form of a parabola and polished inside by a special patented process; the outside or back surface is then ground to a true curve by special machinery and polished; after this it is silvered like the finest French plate mirror. The mirrored surface is heavily copper plated and coated to protect it against the effects of moisture and temperature.

The methods employed in the manufacture of these mirrors are such that they are very true and accurate results are obtained; these methods are unique and patented; they cannot be duplicated. To use our well-known expression—*"There is No Other 'Golden Glow' Reflector—Our Patented Process Fixes That!"* To which for completeness might be added—*"And the 'Crystal Mirror' is Like Unto the 'Golden Glow'!"*

Parabolic surfaces reflect light rays which strike them in a manner similar to that of a mirror; that is, the angle of incidence is equal to the



Figures 1 and 2—Illustrating Fundamental Characteristics of Parabolic Reflecting Surfaces

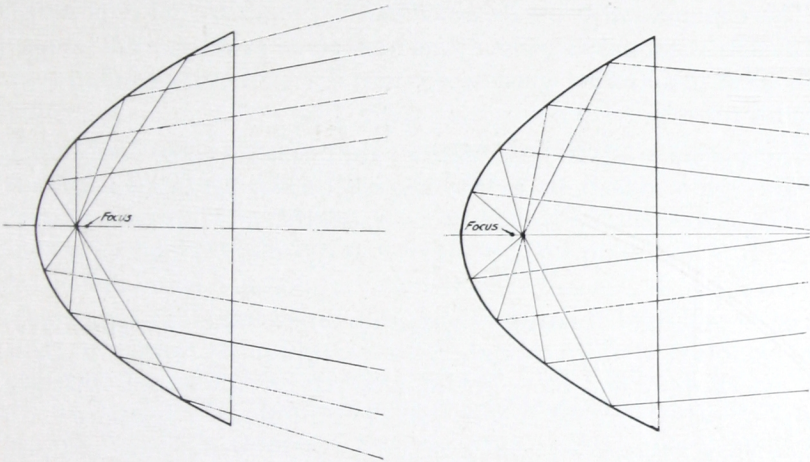
angle of reflection. The shape of a parabolic reflecting surface is such that all light rays which are parallel to the principal axis and which strike the surface are reflected to a common point on the principal axis called the focus. If a point light source is located at the focus of a parabolic reflector, the converse holds true; that is, all the rays from the focus which strike the surface are reflected, parallel to the principal axis, in a uniform beam. (See Fig. 1.)

In flood lighting problems, as well as in all other problems of lighting, we are dealing with finite light sources rather than with the hypothetical "point source" mentioned above; hence in practice we get a certain deviation from parallelism of the projected rays; this is called dispersion, and the included angle between rays on opposite sides of the principal axis is called the angle of dispersion.

This is illustrated in Figure 2. By locating the light source behind of, in, or ahead of the focal point of the mirror we can, to a certain extent, control this angle of dispersion; this is extremely valuable in flood lighting work, for at short range it is evident that we desire a widely dispersed shaft of light, while for long-range projection minimum dispersion is desirable.

Figure 1 shows that maximum beam concentration, or minimum angle of dispersion, is secured when the light source is located exactly at the focal point of the mirror.

Figure 3 shows the effect secured by drawing the filament of the lamp *behind* the focal point; when the extreme outer edge of the filament is just at the focal point, maximum effective dispersion is secured. If it be drawn further behind the focal point, a dark spot begins to appear in the center of the beam; this of course should be avoided in all flood lighting work.



Figures 3 and 4—Illustrating Characteristics of Projected Beam with Light Source Behind and Ahead of Focal Point

Figure 4 shows the effect secured by pushing the filament of the lamp *ahead* of the focal point; with this condition it is seen that the light rays, instead of diverging from the principal axis, *converge* towards it, and at a sufficient distance from the projector the rays will cross and after crossing will of course diverge again.

For flood lighting work placing the light source *at the focus* is its best position for long-range work. Drawing the light source *behind the focus* is preferable to pushing it ahead of same to secure dispersion of the projected beam for average and short-range work.

In focusing the projector to get maximum concentration of the beam, and consequently highest intensity of illumination, it is sufficient to train

the beam on any surface a hundred or so feet away, when by sliding the lamp backward or forward the smallest illuminated area is obtained. This is the desired adjustment and after having secured it the lamp may be locked in position by a wing bolt provided for the purpose.

In focusing to get maximum dispersion of the beam, consequently illuminating the greatest area (though at lessened intensity than for concentrated beams), it is sufficient *to draw the lamp behind the focal point*, at the same time training the beam on any surface a hundred or so feet away. Draw the lamp backward until it evenly illuminates the greatest area, at which point the lamp may be locked in position.

As explained above, the lamp should not be drawn back far enough to produce a dark spot in the center of the beam, as this would be very undesirable for flood lighting purposes.

This explanation of the parabolic mirror, combined with its properties of concentration and dispersion, has been given at this point to make perfectly clear these terms when used later. To return now to the subject of glass mirrors.

The efficiency of "Crystal Mirror" and "Golden Glow" reflectors over all other glass reflectors on the market cannot be questioned. When compared with metal reflectors their superiority becomes overwhelmingly great. It is a well-known fact that metal reflectors cannot be accurately spun to shape; it is equally well known that polished metal and enameled reflectors rapidly deteriorate; those of polished metal, owing to the constant oxidation to which they are subjected, gradually tarnish and blacken and absorb more and more of the light received from the light source; efforts to polish and clean such reflectors result in a scratched, roughened surface. Enameled reflectors suffer from discoloration and peeling, with consequent loss in efficiency.

In contrast to this, "Crystal Mirror" and "Golden Glow" reflectors can be and are ground to mathematically exact curvature. Being of glass, they are permanent. Glass is one of the most enduring of all known materials. They can never tarnish; they will never require repolishing; they can easily be cleaned without scratching or marring the reflecting surface; they retain their high efficiency indefinitely. And although the first cost of these projectors generally exceeds that of projectors equipped with ordinary blown glass or metal reflectors, they are unquestionably the most economical to purchase.

Any reflector, whether of metal or glass, absorbs some of the light which impinges on its surface. In a metal reflector this loss, as has been intimated above, depends upon the degree of finish and the amount of

tarnish which has taken place. The best authorities* give the efficiencies of different reflecting surfaces as follows:

Highly Polished Silver	92-93%
Glass Backed by Silver	82-88%
Highly Polished Brass	70-75%
Highly Polished Nickel	55-65%
Highly Polished Copper	60-70%
Highly Polished Aluminum	50-60%

Tests made on silvered metal reflectors used in the best makes of motor car lamps show a decrease of 15 per cent in the efficiency of metal reflectors after they become tarnished by one year's use. When it is remembered that reflectors used for flood lighting purposes of all sorts are frequently subjected to conditions far more severe than those encountered in automobile service, it is readily seen how rapidly they must decrease in efficiency after comparatively short usage.

"Crystal Mirror" and "Golden Glow" reflectors retain their initial efficiency indefinitely. This has been proven not only in actual service, but also by tests in which they have been exposed for months to high temperatures, to the sun's rays, to smoke, salt water, mist and rain. And owing to the shape and thickness of the glass, as well as the rugged construction of their steel cases, they can scarcely be broken except by treatment or accidents which would demolish any lamp.

"Golden Glow" vs. "Crystal Mirror" Projectors

IN offering for sale two distinct types of flood lighting projectors, questions naturally arise concerning the difference between the two, as well as which is to be preferred for any given service. These questions are easily answered.

The only difference between "Golden Glow" and "Crystal Mirror" projectors is in the reflector or mirror employed. Their mechanical construction is identical. "Crystal Mirror" projectors have their mirrors or reflectors made from crystal clear mirror glass; and when in operation project a flood of *beautiful white light*; this projected light is practically of the same color as that given out by the high efficiency Mazda C lamp used as the light source; the projected beam is, therefore, practically unaltered in color.

"Golden Glow" projectors have their mirrors or reflectors made from a special glass of a greenish-yellow color; and when in operation project

*"The Art of Illumination"—Bell, pp. 47 and 52, 1902.

"Physical Optics"—Wood, p. 466, 1914.

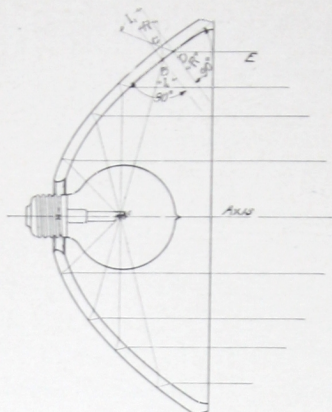


Figure 5—Showing Principle of the
"Golden Glow" Reflector

In the "Golden Glow" parabolic reflector a light ray from focal center O, as for instance ray OB, "called incident ray," on entering parabolic glass body is refracted through glass along B-C, "called refracted ray," to mirrored back and then reflected along C-D to glass surface as an "incident ray," whence it is refracted on line D-E as a "refracted ray" parallel to axis.

In twice passing through the glass the ray has subtracted from it a large percentage of the blue, violet and other high frequency rays, thus leaving the greenish-yellow portion of the light to be projected as the famous "Golden Glow."

a flood of *soft golden-yellow light*. "Golden Glow" mirrors alter or change the color of the light received from the light source. The light source being in front of the reflector and the silver reflecting surface on the back of it (see Fig. 5), it is necessary for the light in passing from the bulb to the reflecting surface to go through the glass, and on leaving the reflecting surface it passes through the glass a second time. The peculiar golden-green glass of the mirror absorbs from the beam of light given by the bulb a large percentage of the high frequency rays—that is, rays above the green portion of the spectrum. In other words, it *absorbs* the blue, indigo, violet and ultra-violet rays, and *passes* and *reflects* the rays of all colors from the green portion of the spectrum and below; so that the light projected from a "Golden Glow" mirror is one as near the color of molten gold as it is possible to obtain; one rich in the soft, non-blinding, greenish-yellow rays of the spectrum. This light is the famous "Golden Glow."

Knowing now the inherent characteristics of the projected light from both "Crystal Mirror" and "Golden Glow" projectors, it becomes a comparatively simple matter to determine which of the two is the better for any particular job of flood lighting.

The light from "Crystal Mirror" projectors is white; it is spectacular; hence it should be used on all flood lighting jobs where spectacular results are desired. As for example, in flood lighting monuments, public buildings, fountains, flags, and practically every subject enumerated under the listing of "Æsthetic Subjects" and "Advertising Subjects" given below: it may also be used to advantage on many of the subjects given under the listing "Pleasure Subjects."

White light can and should preferably be used on all flood lighting subjects where lighting the subject as a whole is the main consideration. It should not be used on subjects requiring the disclosure of very fine detail or on subjects where the eye is to be called into continuous use.

The light from "Golden Glow" projectors is a soft, golden-yellow light, a light rich in rays under which the eye works at its highest efficiency.

Therefore "Golden Glow" light should be used in flood lighting all "Utilitarian Subjects" (see page 12); it should be used for all subjects in which the eye must be able to disclose fine detail, or where the eye is to be called into continuous use.

These two rules make easy the selection of the proper projector for each and every occasion.

Flood Lighting Subjects

A GENERAL summary of the more important uses to which flood lighting may be applied is given below; but its adaptations are so numerous and cover so many fields that to give an entirely adequate presentation is well-nigh impossible.

Aesthetic Subjects

Architecture	Park Lakes
Church Crosses	Park Spaces
Clock Towers	Public Buildings
Flower Gardens	Statues
Fountains	

Advertising Subjects

Advertising Banners	Signs on Chimneys
Automobile Showrooms	Signs on Walls
Billboards	Signs on Water Tanks
Building Exteriors	Spectacular Lighting
Exhibits of All Kinds	Spray Pond Condensers
Fence Lighting	Stained Glass Windows
Flags	Street Squares
Parade Floats	Theatre Fronts
Real Estate Tracts	

Pleasure Subjects

Athletic Fields	Carnivals
Ball Grounds	Confetti Bombs
Bathing Beaches	Dance Halls
Bowling Alleys	Gymnasiums
Boxing Bouts	Hand Ball Courts

Indoor Theatrical Work
 Merchant's Weeks
 Rifle Ranges
 Skating Ponds
 Stadiums
 Tennis Courts
 Toboggan Slides

Trap Shooting
 Winter Sports
 Outdoor Expositions
 Outdoor Theatrical Work
 Pageants
 Race Tracks
 Recreation Centers

Utilitarian Subjects

Ammunition Plants—General
 Illumination
 Anchorages
 Aqueducts
 Arsenals
 Armories
 Aviation Fields
 Barracks
 Bridges and Approaches
 Canal Locks
 Car Barns
 Cement Works
 Channels
 Coal Docks
 Coal Mining—Stripping, etc.
 Coal Piles
 Coal Pockets
 Cold Storage Plants
 Construction Work
 Cutting Ice
 Dredge Operations
 Drill Halls
 Emergency Lighting
 Emergency Repair Work
 Excavation Work
 Express Platforms
 Factory Yards
 Fence Lighting
 Ferry Slips
 Fire Fighting
 Fire Lanes
 Fire Trucks
 Foundry Yards
 Freight Platforms
 General Navigation Purposes
 Grain Elevators
 Highways
 Ice Houses
 Junctions
 Large Factory Assembly Rooms
 Light and Power Plants

Lineman's Repair Wagons—
 Searchlights
 Logging Operations
 Manufacturing Plants—General
 Illumination
 Metal Mining
 Military Camps—General
 Illumination
 Navigation Purposes
 Night Watch
 Oil Fields
 Ore Heaps
 Parade Grounds
 Patrol Boats
 Patrol Duty
 Pier and Dock Lighting
 Pilot Houses
 Pole Storage Yards
 Prison Walls
 Pumping Stations
 Quarries
 Railroad Yards—General
 Illumination
 Railroad Yards—Freight
 Classification
 Railway Platforms
 Railway Terminals
 Reservoirs
 Round Houses
 Shipyards
 Steamer Gangways
 Steam Shovels
 Storage Tanks
 Store Rooms and Aisles
 Tunnels
 Unloading Coal Barges
 Water Works
 Wharves—General Illumination
 Yatch Basins—General Working
 Illumination

Intensity of Illumination Required for Various Flood Lighted Subjects

THE intensity of illumination required for various flood lighted subjects depends, to a large extent, on local conditions; much depends on the color of the building and its surroundings when considering the aesthetic side of flood lighting particularly, and these and other conditions greatly affect any proposition which is contemplated. White marble statues, light gray buildings and similar structures require low intensity of illumination; freight yards and other industrial requirements where great detail is not required likewise call for low intensities. In other work, such as flood lighting buildings of brick, dark-colored buildings, bronze statues, signs with light background or signs which are situated in fairly well-lighted locations, a high intensity of illumination is required to cause them to stand out prominently. Generally speaking, the general run of flood lighting subjects require illumination varying from $\frac{1}{2}$ to 10-foot candles intensity for satisfactory results, or expressed in other words, from 0.1 to 1 watt per square foot of illuminated surface.

Photometric Characteristics

SINCE the 14-inch types of "Golden Glow" and "Crystal Mirror" flood lighting projectors illustrated herein are almost invariably equipped with the 400 watt type concentrated filament Mazda C flood lighting lamp, the discussion of photometric characteristics will be limited to projectors equipped with this lamp.

Curve A of Figure 6 shows the beam candle-power curve of a 14-inch "Crystal Mirror" projector equipped with a standard 400 watt Colonial flood lighting lamp; measurements were taken in a plane across the axis of the beam 100 feet distant from the projector. The lamp being located at the focal point of the reflector, maximum intensity and minimum dispersion of the beam are shown. In this particular case, maximum candle-power of the beam reaches a value of 264,000 with a beam dispersion of 11 degrees.

Curve A of Figure 7 shows the beam candle-power of a 14-inch "Golden Glow" projector equipped with a similar lamp. This shows a maximum beam candle-power of 251,000 with a beam dispersion of 12 degrees. The lower beam candle-power of the "Golden Glow" projector compared with the "Crystal" projector is due to the greater selective absorption which this mirror has for the violet and blue light given off by the bulb. Because of the fluorescing nature of the glass used for the

"Golden Glow" mirror a large percentage of this absorbed radiation is returned to the beam as light of longer wave length, yellowish-green in color; and due to the predominance of this yellow-green light in the projected beam the visual qualities of this "Golden Glow" light are greatly superior to those of the light from the "Crystal Mirror" projector, even with the greater intensity of the latter.

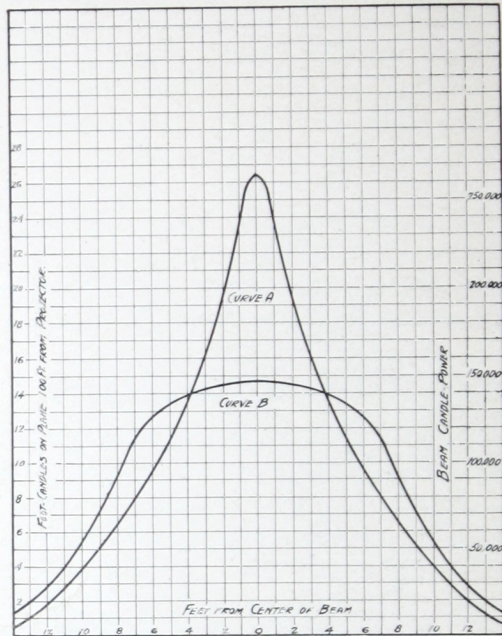


Figure 6—Candle Power Curves of 14-inch "Crystal Mirror" Projector Equipped With 400-Watt Mazda C Flood Lighting Lamp

Curve B of Figure 6 shows the beam candle-power and dispersion of the "Crystal Mirror" projector when the lamp has been moved slightly behind the focal point of the reflector. This, as has been explained, increases the dispersion of the beam, but, of course, decreases its intensity. The dispersed beam from the crystal mirror has a maximum intensity of 148,000 candle-power and a dispersion of 16 degrees.

Curve B of Figure 7 shows a similar curve for the "Golden Glow" projector; here the maximum beam candle-power has a value of 141,000, and a dispersion of 16 degrees.

It should be mentioned that the maximum beam candle-power of a projector equipped with a given size lamp varies among other things with the concentration of the filament, the greater the concentration the greater the beam candle-power; the dispersion varies also with the concentration and becomes smaller as the filament is more concentrated,

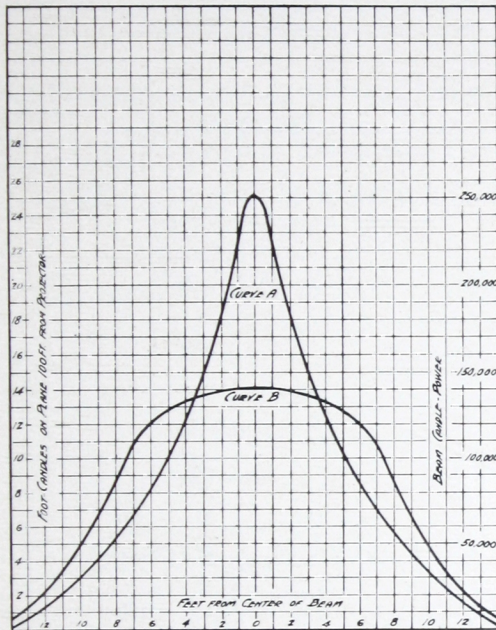


Figure 7—Candle Power Curves of 14-inch "Golden Glow" Projector, Equipped with 400-Watt Mazda C Flood Lighting Lamp

greater as the filament increases more and more in size. Hence a direct comparison between different projectors based on beam candle-power alone is sometimes apt to be misleading. The real basis of comparison for the efficiency of any mirror lies in its *angular efficiency*, that is, the percentage of total light flux from the bulb which is collected and projected into the beam.

The angular efficiencies of both "Golden Glow" and "Crystal Mirror" projectors are the highest of any projectors of similar size on the market, hence their efficiency as light projectors is unsurpassed.

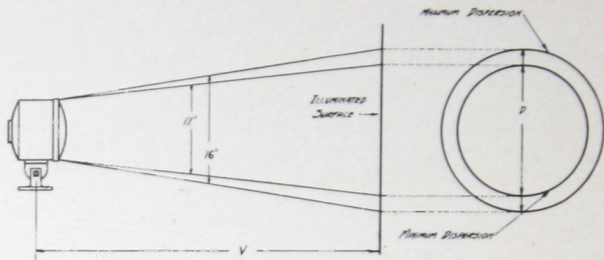


Figure 8—Diagram Illustrating Illumination by Means of Circular Projection

Table A—Diameters and Areas of Surfaces Illuminated Employing Circular Projection

Feet	12° Dispersion		16° Dispersion	
	D Feet	Area Sq. Feet	D Feet	Area Sq. Feet
50.....	10.5	87	14.1	155
100.....	21.0	346	28.1	620
150.....	31.5	779	42.2	1,395
200.....	42.0	1,385	56.2	2,480
300.....	63.1	3,127	84.3	5,580
400.....	84.1	5,554	112.4	9,910
500.....	105.1	8,676	140.5	15,500
600.....	126.1	12,488	168.6	22,350
700.....	147.1	16,995	196.7	30,387
800.....	168.2	22,219	224.8	39,690
900.....	189.2	28,114	252.9	50,233
1,000.....	210.2	34,702	281.0	62,016

Covering Power

THERE are only two ways in which light can be thrown onto a subject—either directly at it, or from an angle. The former method may be termed “Circular Projection” since the area illuminated will be circular in shape; the latter may be termed “Elliptical Projection” since the area illuminated will be elliptical in shape. Circular projection is illustrated diagrammatically in Figure 8; elliptical projection is illustrated diagrammatically in Figure 9.

Table A gives the diameter and areas of circularly illuminated areas with beam dispersions of both 12 and 16 degrees. Table B gives the width, length and areas of elliptically illuminated areas with beam dispersions of both 12 and 16 degrees, taking into account the perpendicular distance of the projector from the illuminated surface and the angle which the central ray makes with this perpendicular.

As has been stated, beam dispersion and beam candle-power depend primarily with any given reflector or mirror on the concentration of the

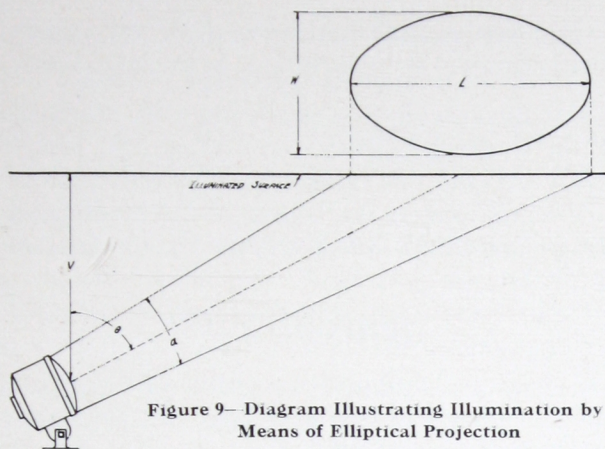


Figure 9—Diagram Illustrating Illumination by Means of Elliptical Projection

Table B—Widths, Lengths and Areas of Surfaces Illuminated Employing Elliptical Projection

V	θ	12° Dispersion			16° Dispersion		
		L (Feet)	W (Feet)	Area (Sq. Ft.)	L (Feet)	W (Feet)	Area (Sq. Ft.)
50 Feet.....	0°	10.5	10.5	86.6	14.1	14.1	155
	15°	11.3	10.9	96.7	15.1	14.6	173
	30°	14.1	12.2	135.1	18.9	16.3	241
	45°	21.2	15.1	251.4	28.7	20.1	452
	60°	43.5	21.4	731.1	59.7	29.0	1,358
100 Feet.....	75°	185.4	51.1	7,440.8	289.4	64.7	14,700
	0°	21.0	21.0	346	28.1	28.1	620
	15°	22.5	21.7	383	30.2	29.1	690
	30°	28.1	24.3	536	37.7	32.6	964
	45°	42.5	30.3	1,011	57.3	40.1	1,808
200 Feet.....	60°	86.9	42.7	2,914	119.5	57.9	5,440
	75°	370.9	102.3	29,800	578.8	129.4	58,800
	0°	42.0	42.0	1,385	56.2	56.2	2,480
	15°	45.1	43.5	1,541	60.3	58.3	2,760
	30°	56.3	48.7	2,153	75.5	65.1	3,860
300 Feet.....	45°	85.0	60.6	4,046	114.7	80.2	7,230
	60°	173.9	85.5	11,678	239.0	115.8	21,750
	75°	741.7	204.6	119,186	1,157.7	258.8	235,400
	0°	63.1	63.1	3,127	84.3	84.3	5,580
	15°	67.6	65.3	3,467	90.5	87.4	6,220
400 Feet.....	30°	84.4	72.9	4,832	113.2	97.7	8,680
	45°	127.5	90.9	9,103	172.0	120.4	16,250
	60°	260.9	128.3	26,290	358.2	173.8	48,900
	75°	1,112.6	306.8	268,083	1,736.5	388.2	529,000
	0°	84.1	84.1	5,554	112.4	112.4	9,910
500 Feet.....	15°	90.2	87.1	6,170	120.7	116.6	11,050
	30°	112.5	97.2	8,588	150.9	130.2	15,430
	45°	170.0	121.2	16,182	229.4	160.5	28,900
	60°	347.9	171.0	46,724	478.1	231.7	87,000
	75°	1,483.4	409.1	476,627	2,315.4	517.6	942,000
500 Feet.....	0°	105.1	105.1	8,676	140.5	140.5	15,500
	15°	112.7	108.8	9,630	150.8	145.7	17,260
	30°	140.6	121.5	13,417	188.6	162.8	24,100
	45°	212.6	151.6	25,314	286.7	200.6	45,200
	60°	434.8	213.7	72,980	597.1	289.6	135,800
	75°	1,854.3	511.4	744,786	2,894.2	647.0	1,470,000

filament of the lamp employed. Hence these values as given may be subject to slight variation with variations in the lamp bulbs employed.

To determine the average foot candle intensity of illumination on the lighted area, the simplest method is to average the beam candle-power for the projector used and this value divided by the square of the distance in feet from the projector to the center of the illuminated surface will give the average foot candle intensity over the illuminated area.

Searchlights

CERTAIN phases of lighting with projectors call for the use of intense and highly concentrated beams of light, and for this work the projector is aptly termed a searchlight.

Searchlights are particularly valuable for use in protective lighting, where their beams may be thrown to great distances, illuminating distant objects to a comparatively high intensity; they find wide application also for various marine purposes; they are used as range lights, trouble lights and much more.

Since a searchlight consists primarily of a concentrated source of light and a highly accurate parabolic reflector, it is at once seen that both the "Golden Glow" and "Crystal Mirror" projectors illustrated herein may be employed as searchlights by providing them with suitable concentrated filament incandescent lamps.

"Golden Glow" and "Crystal Mirror" searchlights have for years been supplied in sizes up to 12 inches and are used generally where the requirements call for incandescent searchlights of maximum efficiency. In the newer 14-inch types there is offered the same high standards as are found in the smaller types with the added advantage of greater range due to the larger capacity incandescent bulbs which it is possible to use.

Depending on the wattage and voltage of the bulb used, we are able to supply incandescent searchlights having effective ranges somewhat greater than a mile. To those familiar with incandescent searchlight performance this may seem somewhat remarkable, but when the superior qualities of both "Golden Glow" and "Crystal" mirrors are considered it is at once seen that such results are easily secured.

There are so many different types of incandescent bulbs that may be employed with these 14-inch mirrors for searchlight purposes that no listing of same is given herein. However, we shall be glad to make recommendations covering same to those interested in this phase of illumination.

General Rules to Be Observed in Flood Lighting Installations

FIRST determine the available locations for the flood lighting projectors and the distances and angles from them to the area to be illuminated.

The area is next to be determined and from this the total wattage necessary to cover same to the desired intensity may be calculated. This total wattage required, divided by the size bulb to be used in the projector (generally 400 watts), gives the number of projectors required.

The projectors will generally have to be located in the most convenient spots; they should, however, always be mounted as accessible as possible as this facilitates the replacing of incandescent bulbs when burned out.

For flood lighting small objects such as signs, etc., the projectors may be trained directly at the object, thus illuminating a circular area; with any given projector, circular projection illuminates a smaller area with a given beam concentration than is the case with elliptical projection; hence the former will produce a higher intensity of illumination than the latter.

Where circular projection is employed on a large area, which it is desired to illuminate fairly uniformly, the beams should be so trained that the illuminated areas will considerably overlap. This is important if a uniform illumination free from "spotty" effects is desired.

In the large majority of flood lighting installations it will be found necessary to train the beams toward the surface at an angle. This is generally to be preferred to projecting directly at a surface as it produces a more even illumination and a consequent freedom from spotty effects.

Elliptically projected beams should be so trained that an overlapping of the illuminated areas is produced. This tends still further to uniformity of intensity on the illuminated area as a whole.

In flood lighting subjects requiring more than one projector, always choose two or more locations for their installation. This causes the light to be thrown on the surface from two or more angles and not only tends toward even and uniform illumination, but also minimizes shadows which would occur if the light were projected from one location only. *This is one rule which can and should be observed in practically every installation.*

The rules about "overlapping" mentioned above may be broadened by stating that no one part of the surface illuminated should be made dependent on only one projector.

Consider the purpose for which any particular job of flood lighting is to be employed, and then decide whether "Golden Glow" or "Crystal Mirror" projectors should be employed. These give different qualities of light, each of which has its own particular field.

Since flood lighting projectors, especially when the rays are concentrated, produce a beam of high intensity, care should be taken to mount them in positions where their rays will not shine directly into one's eyes. This is particularly important when they are used in cities, as for instance in flood lighting buildings facing directly on the street, for here the resulting glare might result in serious accident. This precautionary measure is not so important with "Golden Glow" as it is with "Crystal Mirror" projectors; for at a comparatively short distance away one can look directly into a "Golden Glow" projector with comparatively little discomfort to the eyes.

It is common practice, on account of the above, not to flood light city buildings located directly on the street below a point 10 or 15 feet above the street level.

On page 7 there is given general instructions regarding the focusing of flood light projectors; these are simple in the extreme and easily understood. All types of projectors listed herein have their cases provided with a screw cap on the back; after the units have been mounted and power turned on, the beam may be trained toward the desired location and the projector permanently locked in position. To secure the desired beam dispersion, the cap is unscrewed from the back of the body, when access will be secured to the focusing mechanism; loosening one wing bolt allows the lamp bulb to be moved forward or backward, thus enabling one to secure the beam dispersion desired.

It will be seen that this focusing mechanism is of the universal type whereby vertical and sidewise adjustments of the lamp bulb, together with the forward and backward movements, may be secured. In search-light work this universal focusing must generally be employed to get maximum concentration of the beam and consequently the greatest range. In flood lighting work, however, the use of the universal movement is seldom necessary, hence the vertical and sidewise movements are adjusted at the factory and locked before the projector is shipped, leaving the simple forward and backward movement of the bulb the only required adjustment. If, however, one cares to employ the universal focusing scheme, the nuts may be loosened by means of a small wrench, when movements of the bulb in all directions may be made.



GOLDEN GLOW

**HEADLIGHTS
SEARCHLIGHTS
AND
PROJECTORS**

**ELECTRIC SERVICE SUPPLIES CO.
PHILADELPHIA NEW YORK CHICAGO**



Type FL-1412 Projector

THE above is perhaps the most generally used type of flood lighting projector listed herein, its construction being such that the greatest latitude possible in method of installation and in adaptation to varying classes of service is secured.

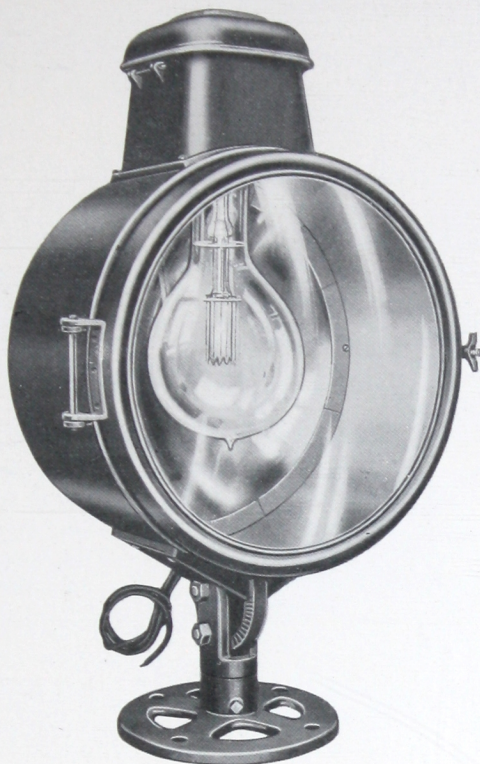
The body proper, including ventilator housing and door, is made of sheet steel; wherever possible electrical spot-welding is utilized instead of riveting, thus resulting in a strong, rigid and weatherproof construction. The door is swung on heavy pressed steel hinges, is fitted with a rubber gasket to assure its being thoroughly watertight and is held securely closed by our standard wing nut latch construction which will not work open.

Standard front glass is curved, this offering greater strength than a plane glass, though projectors equipped with either plane or wired glass fronts can be supplied where desired. Glasses are so installed as to be thoroughly weatherproof.

The mirror is supported in a steel felt-lined shell and is securely held therein by means of eight segments clamping the edge throughout the entire periphery. This steel shell also supports the entire focusing mechanism as well as the incandescent lamp, so relieving the mirror of all strain.

FLOOD LIGHTING PROJECTORS

"GOLDEN GLOW" AND "CRYSTAL MIRROR"



Type FL-1419

Type FL-1419 flood lighting projectors follow the general lines of construction of the standard type FL-1412, but are designed for shorter range work, where wide dispersion of beam with less concentration of the light is desired.

These projectors are equipped with 14-inch, long focus type parabolic "GOLDEN GLOW" or "CRYSTAL MIRROR" reflectors, which are supported in steel, felt-lined shells, securely held throughout the entire periphery.

Type FL-1419 projectors are adapted to use standard type 750 to 1500 watt Mazda C (or nitrogen filled) lamps, and are equipped with standard Mogul sockets arranged with a universal focusing device, by which the filament of the lamp may be brought to the focal centre of the reflector and securely locked.

The type FL-1419 projector has a maximum height of 29½", maximum depth of 14¾", maximum width of 18" and weighs 54 lbs.

Prices do not include incandescent lamps, which are listed separately on Sheet 98 D.

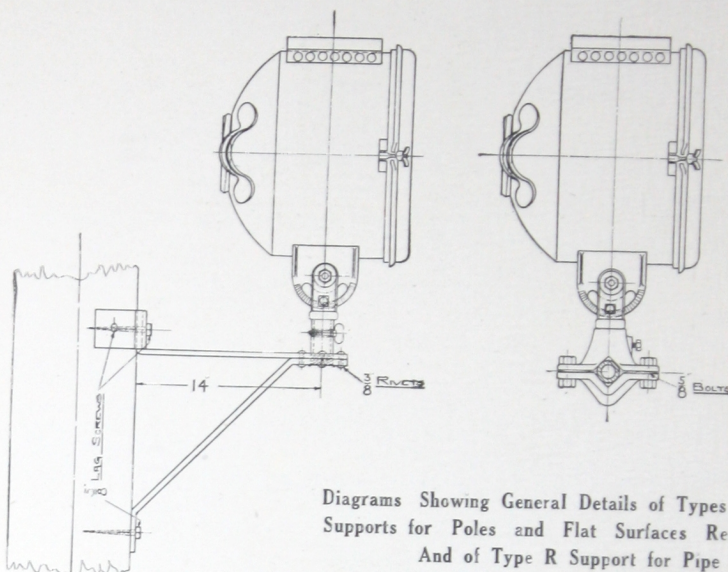
List No.	Type	Reflector Mirror	Front Glass	List Price Each
20511	FL-1419	"Golden Glow"	Curved	\$95.00
20512	FL-1419	"Golden Glow"	Plane	95.00
20513	FL-1419	"Golden Glow"	Wired	99.00
20514	FL-1419	"Crystal"	Curved	95.00
20515	FL-1419	"Crystal"	Plane	95.00
20516	FL-1419	"Crystal"	Wired	99.00

Discounts, Sheet 98 A



FLOOD LIGHTING PROJECTORS

PROJECTOR SUPPORTS



Diagrams Showing General Details of Types B and C Supports for Poles and Flat Surfaces Respectively, And of Type R Support for Pipe

While the standard base as furnished with the type FL-1419 projector is almost universal in its adaptation, there are some instances where it is desirable to mount the projectors on poles, on vertical surface or on pipe framework; for meeting these conditions the types B, C and R supports have been designed.

The type B support consists of two 4 x 1/2 inch bar iron members formed as shown and riveted and welded together. The upper or horizontal member is fitted with an iron segment which partially encircles the pole, resulting in an exceptionally strong and rigid installation.

The type C support consists likewise of two 4 x 1/2 inch bar iron members made similarly to the type B. The type C support is intended for mounting the projector on flat vertical surfaces, such as walls, and is made with a flat upper strengthening segment.

The type R support is designed to allow the projector to be mounted on horizontal pipe; this method is largely used where batteries of projectors are installed at one location and mounted on pipe racks.

The standard type FL-1419 projectors, less the lower base casting, is employed with each of the above three types of supports, the double-jawed swiveling portion of the lamp base fitting directly into each type. The projector can be rotated in any direction, or elevated and depressed at will; provision is made for locking the projector in any desired position.

The listing below covers supports only. In arriving at the list price of any of the type FL-1419 projectors (listed on Sheet 98-C) fitted with either of these supports, deduct \$4.00 from the list price of the desired projector (this \$4.00 is allowance made for lower base casting) and add to the figure so obtained the list price given below for the support desired.

List No.		List Price
20318	Type B Support for Poles	Each
20319	Type C Support for Flat Surfaces	\$14.00
20320	Type R Support for 1 1/2-inch Pipe	14.00
20321	Type R Support for 1 3/4-inch Pipe	6.00
20322	Type R Support for 2-inch Pipe	6.25
		6.50

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Sheet 98 C-2
Aug. 12, 1918

FLOOD LIGHTING PROJECTORS

"GOLDEN GLOW" AND "CRYSTAL MIRROR"



Type PFL 1419

PHILADELPHIA
PITTSBURGH



ELECTRIC SERVICE SUPPLIES CO.



CHICAGO
NEW YORK

FLOOD LIGHTING PROJECTORS

"GOLDEN GLOW" AND "CRYSTAL MIRROR"

Type PFL-1419 flood lighting projectors (illustrated on reverse side of this sheet) differ from the type FL-1419 only in that they are mounted on portable, adjustable standards, making them adaptable for many other classes of service.

These projectors being designed for shorter range work with wide dispersion of beam are equipped with 14-inch, long focus type parabolic "GOLDEN GLOW" or "CRYSTAL MIRROR" reflectors, which are supported in steel, felt-lined shells securely held throughout the entire periphery.

Type PFL-1419 projectors are adapted to use with 750 to 1500 watt type C. Madza (or nitrogen filled) lamps, and are equipped with standard mogul sockets arranged with a universal focusing device, by which the filament of the lamp may be brought to the focal center of the reflector and securely locked.

Minimum height from base to center of reflector, 52¾ inches; maximum height, 73½ inches. Weight, complete, approximately 92 pounds.

Prices do not include incandescent lamps which are listed separately on Sheet 98 D.

List No.	Type	Mirror	Front Glass	List Price Each
20524	PFL-1419	"Golden Glow"	Curved	\$110.00
20525	PFL-1419	"Golden Glow"	Plane	110.00
20526	PFL-1419	"Golden Glow"	Wired	114.00
20527	PFL-1419	"Crystal"	Curved	110.00
20528	PFL-1419	"Crystal"	Plane	110.00
20529	PFL-1419	"Crystal"	Wired	114.00

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FLOOD LIGHTING PROJECTORS

"GOLDEN GLOW" AND "CRYSTAL MIRROR"



Type PDB-1419



FLOOD LIGHTING PROJECTORS

"GOLDEN GLOW" AND "CRYSTAL MIRROR"

Type PDB-1419 flood lighting projectors consist of standard FL-1419 projectors mounted on adjustable pipe stands, which in turn are secured in heavy malleable iron bases. These stands provide an adjustment in height of from 52 to 73 inches, measured from the floor to the center of the reflector, and may be secured at several intermediate points.

These projectors being designed for shorter range work with wide dispersion of beam are equipped with 14-inch, long focus type parabolic "GOLDEN GLOW" or "CRYSTAL MIRROR" reflectors, which are supported in steel, felt-lined shells securely held throughout the entire periphery.

Type PDB-1419 projectors are adapted to use with 750 to 1500 watt type C Madza (or nitrogen filled) lamps, and are equipped with standard mogul sockets arranged with a universal focusing device, by which the filament of the lamp may be brought to the focal center of the reflector and securely locked.

Minimum height from base to center of reflector, 52 $\frac{3}{4}$ inches; maximum height, 73 $\frac{1}{2}$ inches. Weight, complete, approximately 92 pounds.

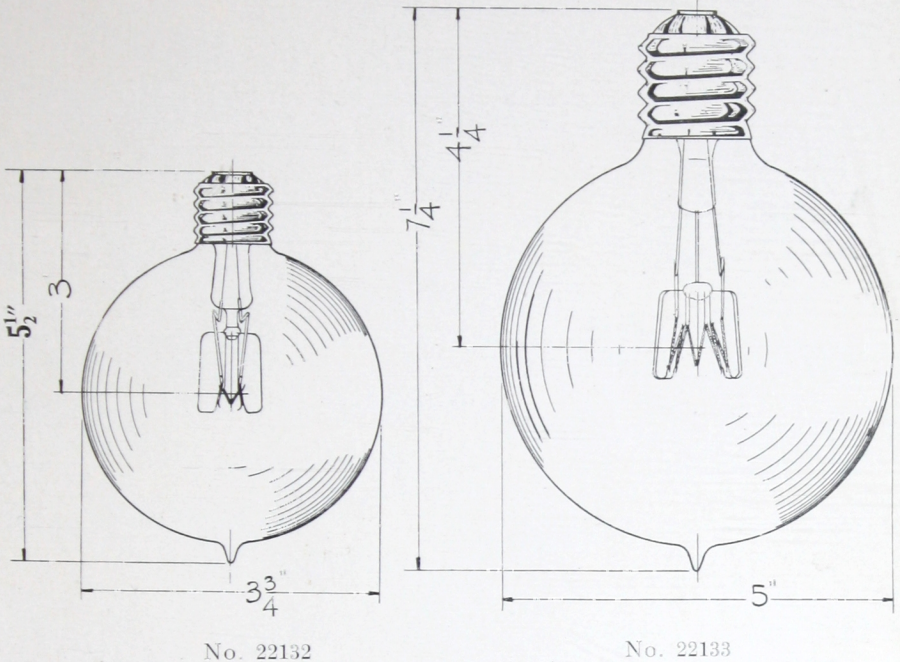
Prices do not include incandescent lamps, which are listed separately on Sheet 98 D.

List No.	Type	Mirror	Front Glass	List Price Each
20612	PDB-1419	"Golden Glow"	Curved	\$115.00
20613	PDB-1419	"Golden Glow"	Plane	115 00
20614	PDB-1419	"Golden Glow"	Wired	119 00
20615	PDB-1419	"Crystal"	Curved	115 00
20616	PDB-1419	"Crystal"	Plane	115 00
20617	PDB-1419	"Crystal"	Wired	119 00

Discounts, Sheet 98 A

INCANDESCENT FLOOD LIGHT LAMPS

FOR TYPE 1412 PROJECTORS



Mazda Type C concentrated filament incandescent lamps in round bulbs are used in Type 1412 "Golden Glow" and "Crystal" mirror flood-lighting projectors where the lamp is mounted in a horizontal position. They are regularly made in the 250 and 500 watt sizes listed below, these superseding the 200 and 400 watt sizes formerly recommended for this service. These latter lamps are listed below and can be supplied if specially desired. In ordering specify exact voltage, otherwise we will supply 115 volt lamps. (Lamps of voltages of 100 to 109 and 126 to 130 are not regularly carried in manufacturers' stock, but may be obtained at same prices as listed below.)

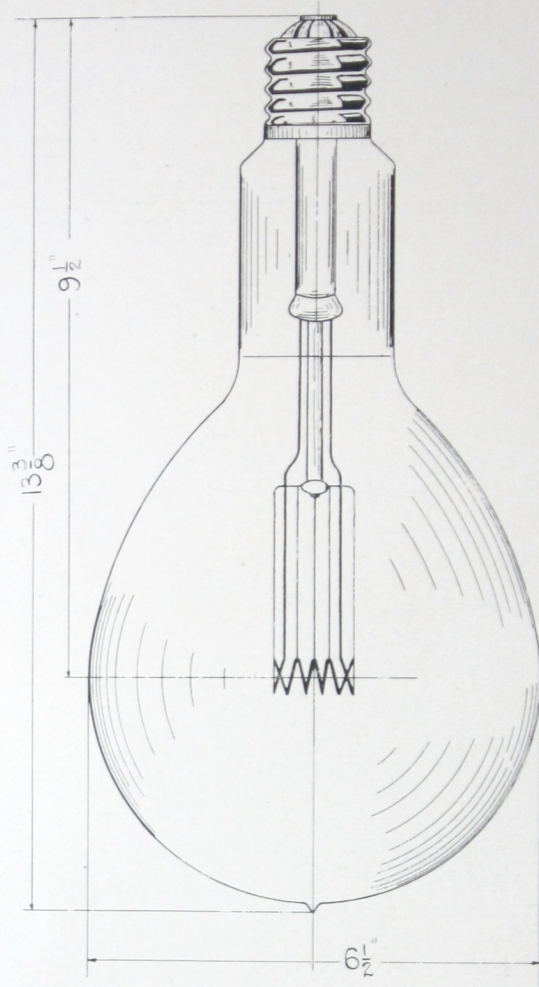
Flood-lighting projectors are regularly supplied with Mogul sockets, hence to use the 200 or 250 watt lamps (which have medium screw bases) a socket adapter is required.

List No.	Total Watts	Voltage	Style Bulb	Light Centre Distance	For Headlights	Standard Package	List Price Each
22132	250	110-125	G-30	3"	Type 1412	24	\$3.00
22133	500	110-125	G-40	4 1/4"	" 1412	12	4.75
20348	200	100-125	G-30	3"	" 1412	24	3.00
20347	400	110-125	G-40	4 1/4"	" 1412	12	4.75
44716	Socket adapter for Mogul to medium base					100	.25



INCANDESCENT FLOOD LIGHT LAMPS

FOR TYPE 1419 PROJECTORS



Mazda Type C incandescent lamps listed below have concentrated filaments and exact light center distances, making them applicable for use in Type 1419 "GOLDEN GLOW" or "CRYSTAL MIRROR" flood lighting projectors.

All lamps are supplied in pear-shaped bulbs of the dimensions specified above and to fit Mogul sockets.

In ordering specify exact voltage, otherwise we will supply 115 volt lamps in the 110-125 volt range and 220 volt lamps in the 220-250 volt range.

(Lamps of voltages of 100 to 109, 126 to 130, 200 to 219 and 251 to 260 are not regularly carried in manufacturers' stock, but may be obtained at same prices as listed below.)

List No.	Total Watts	Voltage	Style	Bulb	Light Centre Distance	For Headlights	Standard Package	List Price Each
44917	750	110-125	PS-52	9 1/2"	Type 1419		8	\$6.50
44929	750	220-250	PS-52	9 1/2"	" 1419		8	7.70
44919	1000	110-125	PS-52	9 1/2"	" 1419		8	7.50
44931	1000	220-250	PS-52	9 1/2"	" 1419		8	9.00
20573	1500	110-125	PS-52	9 1/2"	" 1419		8	12.75
20574	1500	220-250	PS-52	9 1/2"	" 1419		8	15.00

FLOOD LIGHTING PROJECTORS

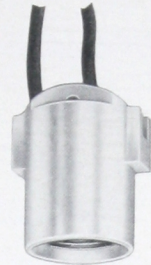
"GOLDEN GLOW" AND "CRYSTAL MIRROR"



Type 1412



Type 1419



No. 20543

Listing below covers principal interchangeable parts for "GOLDEN GLOW" and "CRYSTAL MIRROR" floor lighting projectors, types FL-1412, PDB-1412, PFL-1412, FL-1419 and PFL-1419.

PARTS FOR TYPES FL-1412, PDB-1412, PFL-1412, FL-1419 AND PFL-1419

List No.		List Price Each
20532	Front door, drawn steel, without glass	5.80
20533	Cleats and screws for front glass (old style) (per set).....	.60
20929	Reflector retaining ring with screws	3.00
20534	Front glass only, curved	1.80
20535	Front glass only, plane	1.50
20536	Front glass only, wired	5.50
20537	Front glass only, 25 degrees circular dispersion lens	6.60
20538	Type 1412 "GOLDEN GLOW" reflector, 14 inch dia.	27.50
20539	Type 1412 "CRYSTAL MIRROR" reflector, 14 inch dia...	27.50
20540	Type 1419 "GOLDEN GLOW" reflector, 14 inch dia, long focus	27.50
20541	Type 1419 "CRYSTAL MIRROR" reflector, 14 inch dia, long focus	27.50
20928	Clamping ring for door glass with screws	3.00
20542	Reflector holding segments and screws (per set of 8) (old style)	1.00
20544	Base swivel, cast bronze	11.00
20545	Base swivel, malleable iron	3.50
20571	Hand hole cover, screw type (old style)	1.00
20572	Hand hole cover, hinged type	1.50

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Type FL-1412 Projector (Concluded)

The projector is amply ventilated, cold air entering same through openings in the lower portion of the door; this circulates around the lamp and mirror, portions passing behind the mirror through openings provided in the lower retaining segment, other portions rising and passing through openings in the upper retaining segment, while still other portions pass into the mirror and around the lamp base where, passing backwards through the mirror opening, they cool the base of the lamp and all mechanism having to do with its support and focusing. All heated air passes out through the ventilator located on top of the housing. This system of ventilation has proven almost ideal, keeping the lamp, mirror and mechanism at a reasonable temperature at all times.

To the lamp casing proper is mounted a heavy cast quadrant, this being supported in a double-jawed swivelling base; by means of this construction the lamp may be rotated in any direction or elevated or depressed at will, thus enabling the operator to accurately train the beam on any object to be illuminated; means are provided for permanently locking the lamp in any desired position.

Type FL-1412 projectors are normally furnished with leading-in wires which enter the case through porcelain bushings; where desired, however, wire outlets will be arranged to take $\frac{1}{2}$ -inch conduit.

Since the 400 watt concentrated filament Mazda bulb is commonly employed with these projectors, they are furnished only with Mogul sockets; where it is desired to equip them with lamps having medium screw bases an adapter is required; these are listed on page 33.

They are furnished with either 14-inch "Golden Glow" or "Crystal Mirror" reflectors, the type for any class of service being easily determined by reference to the rules given on page 11. Standard finish is black baked enamel. Prices below do not include incandescent Mazda lamps. For listing of incandescent lamps see page 33.

The type FL-1412 projector has a maximum height of $23\frac{1}{2}$ inches; maximum depth, $14\frac{3}{4}$ inches; maximum width, $18\frac{1}{2}$ inches; and weighs 52 pounds.

List No.	Type	Mirror	Front Glass	List Price Each
20341	FL-1412	"Golden Glow"	Curved	\$95.00
20342	FL-1412	"Golden Glow"	Plane	95.00
20343	FL-1412	"Golden Glow"	Wired	99.00
20344	FL-1412	"Crystal"	Curved	95.00
20345	FL-1412	"Crystal"	Plane	95.00
20346	FL-1412	"Crystal"	Wired	99.00



Type PFL-1412 Projector

As seen, the type PFL-1412 flood lighting projector is exactly similar in general construction to the type FL-1412, described on pages 22 and 23, but differs from it in that it is mounted on a pipe standard, thus adapt-

Type PFL-1412 Projector (Concluded)

ing it for flood lighting purposes where portability of the flood lighting unit is desired.

The lower end of the double-jawed base of the standard support fits directly into the upper end of the telescoping pipe support; the projector so may be rotated in any direction or elevated or depressed at will, thus enabling the operator to train the beam on any object to be illuminated; means are provided, as seen, for locking the lamp in any desired position.

The telescopic pipe standard provides an adjustment in height of from $52\frac{3}{4}$ to $73\frac{1}{2}$ inches, measured from the base to the center of the reflector, which elevation may be secured at several intermediate points. When shipped, the pipe standard is unscrewed from the base proper; to facilitate assembly, the lower end of the pipe is provided with a $\frac{7}{16}$ -inch hole through which a steel bar may be inserted and used as a lever in screwing the pipe back into the base. A 6-inch length of $\frac{3}{8}$ -inch cold rolled steel bar is shipped with each projector for this purpose.

Type PFL-1412 projectors are furnished with either "Golden Glow" or "Crystal Mirror" reflectors, 14-inch diameter, the type for any class of service being easily determined by reference to the rules given on page 11. Front glass is regularly furnished curved, though plane or wired glass will be furnished when desired.

They are fitted with attachment cord and plug, the cord being purposely made short, as illustrated, to facilitate transferring the lamp from place to place. Mogul sockets only are furnished; where it is desired to equip the projectors with lamps having medium screw bases an adapter is required; these are listed on page 33.

The standard finish given these projectors is black baked enamel. Prices below do not include incandescent Mazda lamps. For listing of incandescent lamps see page 33.

Minimum height of the type PFL-1412 projector from base to center of mirror is $52\frac{3}{4}$ inches; maximum height, $73\frac{1}{2}$ inches; maximum depth of projector case, $14\frac{3}{4}$ inches; maximum width of projector case, $18\frac{1}{2}$ inches; diameter of base, 20 inches; weight, 85 pounds.

List No.	Type	Mirror	Front Glass	List Price Each
20312	PFL-1412	"Golden Glow"	Curved	\$110.00
20313	PFL-1412	"Golden Glow"	Plane	110.00
20314	PFL-1412	"Golden Glow"	Wired	114.00
20315	PFL-1412	"Crystal"	Curved	110.00
20316	PFL-1412	"Crystal"	Plane	110.00
20317	PFL-1412	"Crystal"	Wired	114.00



Type DDB-1412 Projector

TYPE DDB-1412 projectors are used not only for flood lighting purposes, but also as harbor lights, marine searchlights, spot lights, trouble lights, and for other purposes requiring powerful illumination from a quickly and easily controlled source.

The details of body construction, mirror mounting, system of ventilation and other fundamental details are similar in all respects to those embodied in the type FL-1412 projector described on pages 22 and 23; they differ from this type, however, in that they are mounted on heavy malleable iron forks and stands, thus permitting quick and easy control in both horizontal and vertical planes. Provision is made for locking the projector in any desired position.

They are normally furnished with leading-in wires which enter the case through porcelain bushings; where desired, however, wire outlets

Type DDB-1412 Projector (Concluded)

will be arranged to take 1/2-inch conduit. They are equipped only with Mogul sockets; where it is desired to equip the projectors with lamps having medium screw bases an adapter is required; these are listed on page 33.

Either "Golden Glow" or "Crystal Mirror" reflectors, 14-inch diameter, may be secured in this projector, the type for any class of service being easily determined by reference to the rules given on page 11. Front glass is regularly furnished curved, though plane or wired glass will be furnished when desired.

The standard finish given these projectors is black baked enamel. Prices below do not include incandescent Mazda lamps. For listing of incandescent lamps see page 33.

Maximum height of the type DDB-1412 projector is 28 1/2 inches; maximum depth, 14 3/4 inches; maximum width, 19 1/4 inches; weight, 57 pounds.

List No.	Type	Mirror	Front Glass	List Price Each
20335	DDB-1412	"Golden Glow"	Curved	\$102.50
20336	DDB-1412	"Golden Glow"	Plane	102.50
20337	DDB-1412	"Golden Glow"	Wired	106.50
20338	DDB-1412	"Crystal"	Curved	102.50
20339	DDB-1412	"Crystal"	Plane	102.50
20340	DDB-1412	"Crystal"	Wired	106.50



Type PDB-1412 Projector

AS seen, the type PDB-1412 projector is exactly similar in general construction to the type DDB-1412, described on pages 26 and 27, but differs from it in that it is mounted on a pipe standard, thus adapting

Type PDB-1412 Projector (Concluded)

it for flood lighting purposes where portability of the flood lighting unit is desired.

The lower end of the supporting fork fits directly into the upper end of the telescoping pipe support; the projector so may be rotated in any direction or elevated or depressed at will, thus enabling the operator to train the beam on any object to be illuminated; means are provided, as seen, for locking the lamp in any desired position.

The telescopic pipe standard provides an adjustment in height of from $52\frac{3}{4}$ inches to $73\frac{1}{2}$ inches, measured from the base to the center of the reflector, which elevation may be secured at several intermediate points. When shipped, the pipe standard is unscrewed from the base proper; to facilitate assembly, the lower end of the pipe is provided with a $\frac{7}{16}$ -inch hole through which a steel bar may be inserted and used as a lever in screwing the pipe back into the base. A 6-inch length of $\frac{3}{8}$ -inch cold rolled steel bar is shipped with each projector for this purpose.

Type PDB-1412 projectors are furnished with either "Golden Glow" or "Crystal Mirror" reflectors, 14-inch diameter, the type for any class of service being easily determined by reference to the rules given on page 11. Front glass is regularly furnished curved, though plane or wired glass will be furnished when desired.

They are fitted with attachment cord and plug, the cord being purposely made short, as illustrated, to facilitate transferring the lamp from place to place. Mogul sockets only are furnished; where it is desired to equip the projectors with lamps having medium screw bases an adapter is required; these are listed on page 33.

The standard finish given these projectors is black baked enamel. Prices below do not include incandescent Mazda lamps. For listing of incandescent lamps see page 33.

Minimum height of the type PDB-1412 projector from base to center of mirror is $52\frac{3}{4}$ inches; maximum height, $73\frac{1}{2}$ inches; maximum depth of projector case, $14\frac{3}{4}$ inches; maximum width of projector case, $19\frac{1}{4}$ inches; diameter of base, 20 inches; weight, 89 pounds.

List No.	Type	Mirror	Front Glass	List Price Each
20323	PDB-1412	"Golden Glow"	Curved	\$115.00
20324	PDB-1412	"Golden Glow"	Plane	115.00
20325	PDB-1412	"Golden Glow"	Wired	119.00
20326	PDB-1412	"Crystal"	Curved	115.00
20327	PDB-1412	"Crystal"	Plane	115.00
20328	PDB-1412	"Crystal"	Wired	119.00



Type HDB-1412 Projector

TYPE HDB-1412 projectors are used not only for flood lighting purposes, but also as harbor lights, powerful headlights for railway service, and for other purposes for which a fixed projector is adapted.

The body construction, mirror mounting, system of ventilation and other fundamental details are similar in all respects to those embodied in the type FL-1412 projector, described on pages 22 and 23; they differ from this type, however, in that they are mounted on cast-iron legs as shown. The body so may be tilted and secured at any angle, but no means is provided for rotating the lamp horizontally.

They are normally furnished with leading-in wires which enter the case through porcelain bushings; where desired, however, wire outlets will be arranged to take $\frac{1}{2}$ -inch conduit. They are equipped only with Mogul sockets; where it is desired to equip the projectors with lamps having medium screw bases an adapter is required; these are listed on page 33.

Either "Golden Glow" or "Crystal Mirror" reflectors, 14-inch diameter, may be secured in this projector, the type for any class of service

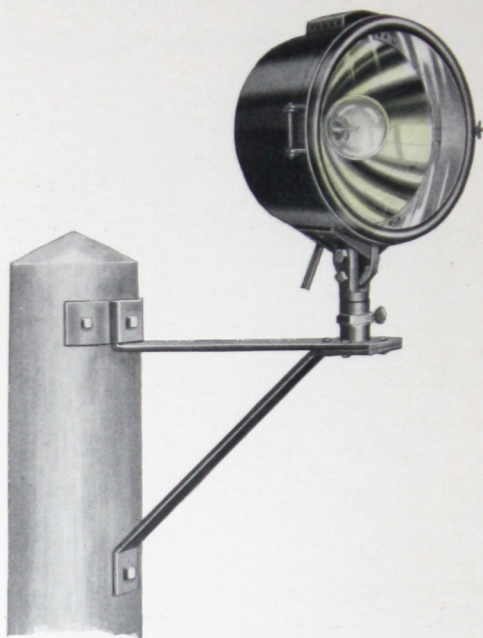
Type HDB-1412 Projector (Concluded)

being easily determined by reference to the rules given on page 11. Front glass is regularly furnished curved, though plane or wired glass will be furnished when desired.

The standard finish given these projectors is black baked enamel. Prices below do not include incandescent Mazda lamps. For listing of incandescent lamps see page 33.

Maximum height of the type HDB-1412 projector is $19\frac{5}{16}$ inches; maximum depth, $14\frac{3}{4}$ inches; maximum width, $19\frac{3}{8}$ inches; weight, 48 pounds.

List No.	Type	Mirror	Front Glass	List Price Each
20329	HDB-1412	"Golden Glow"	Curved	\$90.00
20330	HDB-1412	"Golden Glow"	Plane	90.00
20331	HDB-1412	"Golden Glow"	Wired	94.00
20332	HDB-1412	"Crystal"	Curved	90.00
20333	HDB-1412	"Crystal"	Plane	90.00
20334	HDB-1412	"Crystal"	Wired	94.00



Projector Supports

WHILE the standard base as furnished with the type FL-1412 projector is almost universal in its adaptation, there are some instances where it is desirable to mount the projectors on poles, on vertical surface or on pipe framework; for meeting these conditions the types B, C, and R supports have been designed.

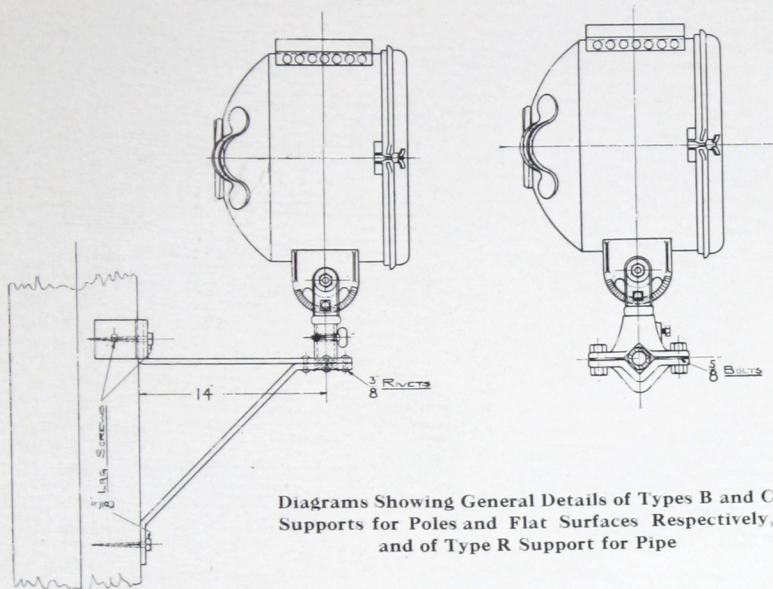
The type B support consists of two 4 x $\frac{1}{2}$ inch bar iron members formed as shown and riveted and welded together. The upper or horizontal member is fitted with an iron segment which partially encircles the pole, resulting in an exceptionally strong and rigid installation.

The type C support consists likewise of two 4 x $\frac{1}{2}$ inch bar iron members made similarly to the type B. The type C support is intended for mounting the projector on flat vertical surfaces, such as walls, and is made with a flat upper strengthening segment.

The type R support is designed to allow the projector to be mounted on horizontal pipe; this method is largely used where batteries of projectors are installed at one location and mounted on pipe racks.

The standard type FL-1412 projector, less the lower base casting, is employed with each of the above three types of supports, the double-jawed swiveling portion of the lamp base fitting directly into each type. The projector can be rotated in any direction, or elevated and depressed at will; provision is made for locking the projector in any desired position.

Projector Supports (Concluded)



Diagrams Showing General Details of Types B and C Supports for Poles and Flat Surfaces Respectively, and of Type R Support for Pipe

The listing below covers supports only. In arriving at the list price of any of the type FL-1412 projectors (listed on page 23) fitted with either of these supports, deduct \$4.00 from the list price of the desired projector (this \$4.00 is allowance made for lower base casting) and add to the figure so obtained the list price given below for the support desired.

List No.		List Price Each
20318	Type B Support for Poles.....	\$14.00
20319	Type C Support for Flat Surfaces.....	14.00
20320	Type R Support for 1½-inch Pipe.....	6.00
20321	Type R Support for 1¾-inch Pipe.....	6.25
20322	Type R Support for 2-inch Pipe.....	6.50

Bulbs and Accessories

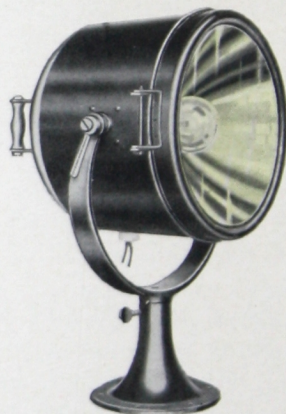
Since the 400 and 200 watt concentrated filament Mazda C flood lighting bulbs are generally the only two types used in connection with the flood lighting projectors listed herein, they alone are listed below. Projectors are regularly fitted with Mogul sockets, hence to use the 200 watt bulb (which has a medium screw base) an adapter is required.

Information relative to proper bulbs for searchlight work will be given upon receipt of information pertaining to such application.

List No.	For Use In	Voltage	Capacity	Light Center Length	Style Bulb	Base	Standard Package	Price Each
20347	1412-Lamp	115	400 watts	4¼	G-40	Mog. Screw	12	\$4.50
20348	1412-Lamp	115	200 watts	3⅞	G-30	Med. Screw	24	2.70
44716	Socket adapter		Mogul to medium base				100	.25



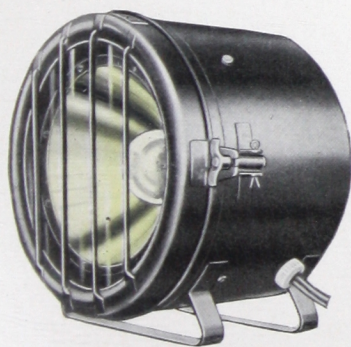
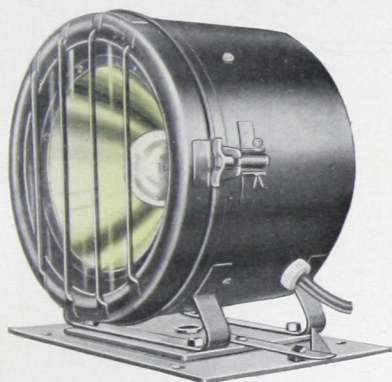
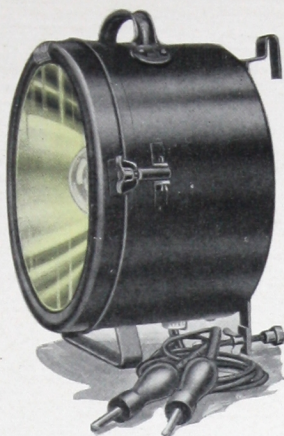
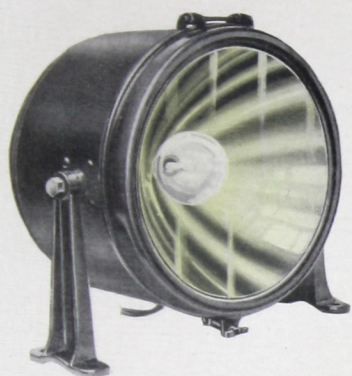
"The Non-Blinding
Searchlight"



"It Penetrates Fog
and Mist"

Some Typical "Golden Glow" Marine Searchlights

(Complete Catalog on Request)



Some Typical "Golden Glow" Electric Railway
and Mine Headlights

(Complete Catalog on Request)

Flood Lighting Projectors



"Golden Glow" and "Crystal Mirror"

Manufactured by

ELECTRIC SERVICE SUPPLIES CO.

Railway Material and Electrical Supplies

PHILADELPHIA...17th and Cambria Streets
CHICAGO.....Monadnock Building
NEW YORK.....50 Church Street

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